

### Remarks

This application has been carefully reconsidered in light of the Office Action of October 10, 2000. By this response, claims 28 and 29 have been added. Claim 28 is dependent from claim 1 and recites the catalyst as having a silicon/aluminum ratio of at least 300. Claim 29 specifies this ratio as within the range of 300-500. Support for these claims is found in applicants' specification in the full paragraphs of pages 14 and 15. In addition, new claims 30-33 have been added herewith. Claim 30 is similar to claim 1 but characterizes the silicate catalyst as being selected from the group consisting of ZSM-5 and silicalite. Support for claim 30 is found in applicants' specification, for example, at pages 15, 20, and 22 (silicalite) and at pages 31 and 42 (ZSM-5 zeolite). Claims 31 and 32 depend from claim 30, and like claims 28 and 29 specify the silicon/aluminum atomic ratio to be at least 300 or within the range of 300-500. Claim 33 further specifies the catalyst to be monoclinic silicalite. Support for the use of monoclinic silicalite in applicants' invention is found in the specification, for example, at pages 25 and 30.

Reconsideration and allowance of this application is respectfully requested for the reasons set forth below.

Turning now to the prior art rejections made in the previous Office Action, applicants respectfully traverse the rejection of claims 1, 2, 7-10, and 12 under 35 U.S.C. § <sup>2</sup>107 as anticipated by EP 109060. As the Examiner has acknowledged, EPA '060 does not disclose the range of the silicon/aluminum atomic ratio of 180-1000 as called for in claim 1. In fact, EP '060 not only fails to (1) disclose this range, or the preferred range having a lower limit of 300 or of 300-500 as now set forth in claims 28, 29, 31, and 32, but instead simply refers to a silicon/aluminum ratio of at least 175 with no upper limit, disclosing a catalyst in which no aluminum is present, *i.e.* a silicon/aluminum

ratio of infinity. Thus, the disclosure in EPA '060 is that the silicon/aluminum atomic ratio is of no significance and, in fact, that it makes no difference whether or not aluminum is even present in the catalyst. Applicants would respectfully submit that the Examiner is in error in suggesting a very broad range anticipates a specific narrower range included within the broad range. Specifically, to the extent that the rejection, whether based under § 102 or § 103 as discussed below, relies upon the premise that the disclosure of very broad ranges encompassing narrow ranges amounts to a disclosure of such narrow ranges or renders the use of such ranges obvious, applicants would respectfully disagree. It is believed to be well established that the existence in the prior art of broad ranges which encompass narrow ranges presented in the claims does not establish lack of novelty or obviousness of such ranges. In this regard, attention is respectfully invited to *In re Russell*, 169 USPQ 426, CCPA (1971) wherein the court in reversing the rejection of the claims stated:

Essentially, appellant's contention is that the employment of the proportions recited in the claims unexpectedly yields clear compositions without the need for a filtration step. Appellant's position on the law is sound, for even though part of appellant's range of proportions, and all of his ingredients, are suggested by the broad teaching of Wei, if appellant can establish that his relatively narrow ranges yield unexpectedly superior results as against the broad Wei ranges as a whole, appellant will have established unobviousness of the claimed invention. See *In re Luvisi*, 51 CCPA 1063, 342 F.2d 102, 144 USPQ 646 (1965); *In re Neave*, 54 CCPA 999, 370 F.2d 961, 152 USPQ 274 (1967).

For a similar holding, reference is made to *In re Waymouth and Koury*, 182 USPQ 290, CCPA (1974). In this case, the claims on appeal were directed to a lamp having an arc tube containing halogen in mercury atoms present in a ratio of 0.08 to 0.75. The prior art reference disclosed a similar device containing halogen and mercury atoms. The calculated ratio of halogen to mercury atoms inherently disclosed in the reference ranged from 0.0000001 to 1.3. Although the prior art range enveloped the narrower range claimed by appellant, the court reversed the rejection of the claims in view of the unexpectedly superior results achieved by operating within the claimed range.

In the present case, similarly as in the *Russell* and *Waymouth* decisions, applicants' invention involves the use of the catalyst having characteristics which are not taught by the prior art and which produce unexpectedly superior results which are not recognized by the prior art references. Accordingly, applicants respectfully submit that the invention is patentable over the prior art reference.

In addition to the requirement in applicants' claim 1 of a silicon/aluminum atomic ratio of 180 to 1,000, applicants' claimed process requires an inlet temperature of 500° to 600° C and a space velocity (LHSV) of 10 to 30 hrs<sup>-1</sup>. Claims 13 and 14, rejected under § 103, further require an olefin partial pressure of from 0.1 to 2 bar. EPA '060 does not disclose or suggest this particular combination of parameters and instead discloses, in addition to the very broad range of the silicon/aluminum ratio, broad ranges of olefin partial pressure, space velocity, and temperature. Thus, EPA '060 specifies a temperature of 400° to 600° C, a space velocity of 5 to 200 hrs<sup>-1</sup>, and a pressure of 1.5 to 7.5 atmospheres. The only qualification on space velocity appears to be a space velocity of less than 50 hrs<sup>-1</sup> if the pressure is atmospheric and greater than 50 hrs<sup>-1</sup> at a pressure of from 1.5 to 7.5 atmospheres. In fact, with the single exception of Example 36, the space velocity in EPA '060 is well below the 10 to 30 hrs<sup>-1</sup> range called for in applicants' claims or well above this range as in Examples 32-35. Example 36 of EP '060 does disclose a space velocity of 20 hrs<sup>-1</sup>. However, Example 36 does not specify a silicon/aluminum atomic ratio within the range called for in applicants' claims, and the only inference that can be drawn from the reference disclosure is that this ratio, like the ratio of the other examples of silicalite -1 disclosed in the reference, is well above the upper limit of 1,000 called for in the claim. In this respect, every example of silicalite -1, as described in EP '060 specifies that no aluminum is present.

Applicants would respectfully disagree with the Examiner's apparent position that the various examples disclose that the olefin contents of the feed and product are substantially the same by weight or within  $\pm 15\%$  of each other as set forth in claim 10. Further, it will be noted (3) that claim 10, by its dependency from claim 1, requires, in addition, the temperature range of  $500^{\circ}\text{-}600^{\circ}\text{C}$  and the space velocity of 10 to 30  $\text{hrs.}^{-1}$ . As noted above, with the exception of Example 36, all of the space velocities shown in the various examples of EP '060 are outside of the claimed range. As to relative olefin content of the feed and the effluent, there is no clear indication in the various examples that these values are within the  $\pm 15\%$  specification. In some cases they are clearly outside of this range. For example, the products in Examples 16-23, which show high selectivity to (BTX) clearly do not involve an effluent having an olefin content within (X)  $15\%$  of the olefin content of the product stream. In other examples it is impossible to determine whether the claimed relationship between the feed stream and the effluent stream is met. Similarly, Examples 1-6 show a very high product in the effluent of  $\text{C}_{5+}$  compounds. It is not clear whether these are saturated or unsaturated, and thus again, a determination as to the relevant olefin content of the feedstock and effluent cannot be made. In any event, it will be recalled that whether or not these various examples involve an effluent and a feedstock having olefin contents within  $15\%$ , they clearly do not involve the space velocity requirements of parent claim 1. The sole example of EP '060, which does indicate a space velocity within applicants' claimed range, is Example 36, as noted above. Example 36 does not, however, disclose the relationship between the olefin content of the feed and the effluent  $\pm 15\%$ . In fact, from what is disclosed in Example 36, the relative olefin content of the feed and effluent could well be far outside this range. In this respect, the olefin content of the feed in Example 36 is 100% normal butene whereas the identified olefin content of the effluent (propylene, ethylene, and

isobutylene) is about 50%. About 4-5% of the effluent is identified as saturated gases, with the remainder being identified as  $C_{5+}$  liquids. Presumably, substantial portions of these liquids would be olefins resulting from butene oligomers which are unsaturated. However, if as much as even 30% of the  $C_{5+}$  liquids are saturated, it is clear that the olefin content of the effluent would not be within 15% of the olefin content of the feedstock. (24)

Applicants would further respectfully submit that the Examiner is in error in the assessment of the  $C_2$ - $C_3$  compounds in the effluent of the '060 patent as reflected by the following statement: "The examples indicate selectivity of  $C_4$  saturated compounds of less than 5 wt.%. Therefore at least 95% of the  $C_2$  and  $C_3$  compounds present in the product must be olefins." However, the percentages expressed in claims 7 and 8 are with respect to the  $C_2$  and  $C_3$  compounds and not the entire product. Thus, the requirement in claim 8, for example, is that at least 95% of the  $C_2$  and  $C_3$  compounds present in effluent are present as  $C_2$  and  $C_3$  olefins. The various examples in the '060 patent either indicate directly or at least allow the possibility of a very much lower olefin content of the  $C_2$  and  $C_3$  compounds in the effluent. Thus, Examples 1-6, for example, show selectivity to ethylene and propylene ranging from about 24% in Example 6 to about 54% in Example 3. When the reported selectivity to saturated  $C_4$  compounds are measured in terms of the olefin content in the effluent, it is evident that the substantially less than 95% of the  $C_2$  and  $C_3$  compounds are olefins. For example, based upon the  $C_2$ ,  $C_3$  olefin content of the effluent, the  $C_4$  saturated compound content would range from about 14% in Example 3 ( $6.85 \div (44.79 + 4.95)$ ) to about 20% in Example 6 ( $4.77 \div (23.65 + .31)$ ). In the various other examples, the selectivity to saturated compounds of less than 4 carbon atoms is in some cases much less, but these examples appear to show a wide variance between the olefin content of the (25)

effluent when compared with the olefin content of the feed because of the relatively high amounts of other compounds, such as the BTX content as described above.

The rejection of claims 1, 4-6, and 13 and 14, under 35 U.S.C. § 103 as unpatentable over EP '060 is respectfully traversed. In addition to the patentability of claim 1 over EP '060, the additional reasons for patentability of claims 13 and 14 are discussed above. With respect to the feedstocks as specifically specified in claims 4-6, applicants would respectfully disagree with the assertion made in the Office Action that obviousness is established because the claim feeds are chemically and physically similar to the feeds disclosed in EP '060. In fact, the feedstocks disclosed in EP '060 are distinctly different from those claimed. In the various examples as discussed above, in every case the feedstocks are pure olefins or olefins mixed with helium. The '060 patent does disclose the application of the process disclosed there to feedstocks involving a mixture of olefins with other components including substantial amounts of paraffins. However, here the '060 process appears to involve an initial oligomerization step to produce a mixture of higher molecular weight olefins with C<sub>4</sub>+ saturated compounds. Thus, the '060 reference when considered as a whole would appear to actually teach away from employing feedstocks such as those specified in applicants' claims 4-6.

The rejection of claims 16-20 as unpatentable in view of EP '060 in view of Cosyns et al is respectfully traversed. For reasons advanced below, applicants would respectfully submit that the teachings of EP '060 and Cosyns cannot be selectively combined in order to arrive at applicants' invention without a hindsight reconstruction of the prior art references made with the benefit of applicants' disclosure. Further, it is to be recognized that even if one of ordinary skill in the art were, after considering applicants' disclosure, to attempt to combine EP '060 and Cosyns, the results clearly would not involve the selective hydrogenation of dienes in an olefin-

rich stream to form at least one olefin and further to form a feedstock having a maximum diene concentration of 0.1 wt.%. In this respect, Cosyns does not disclose the selective hydrogenation of a feedstock even remotely similar to that involved in EP '060 or in applicants' process. The feedstock in Cosyns is not an olefin-rich stream as called for in claim 1, from which claim 16 depends, but instead is a feedstock containing high concentrations of aromatic compounds. The only analysis of the feedstock employed in Cosyns is disclosed in the first table appearing in column 4 of the reference. Here, we find that the feedstock is predominantly aromatic, followed by 16% dienes, 12% paraffins, and only 4% olefins. Applicants would respectfully submit that a bare similarity in feedstocks between two references would not, in itself, provide a basis for combining the prior art references, but here even that factor is clearly missing. Further, Cosyns does not disclose that the dienes are converted into mono-olefins, and it is clear that Cosyns does not suggest a maximum diene concentration of 0.1 wt.%. In fact, if the Cosyns procedure is somehow combined with EP '060, the various maleic anhydride index (MAI) values given in Cosyns confirm that the diene content for the resulting product would be much higher than the maximum diene content specified in applicants' claims. In this respect, the various examples in Cosyns disclose MAI values ranging from 2 to 8 for the product. Based upon an initial MAI value of 106 for the feedstock containing 16% dienes, it is evident that the diene content of the product may range from about 3 up to about 10 times applicants' maximum diene content of 0.1%.

The rejection of claim 24 as unpatentable over EP '060 in view of Cosyns further in view of Gajda et al is respectfully traversed. As in the case of the rejections discussed above, there is no basis, absent applicants' teachings, for the proposed combination of prior art teachings. Further, it is respectfully submitted that the Examiner is in error in suggesting that Gajda et al

discloses a pretreating step to product the desired silicon/aluminum atomic ratio of the catalyst employed in applicants' invention. Gajda, in the first full paragraph of column 3, discloses increasing the silicon/aluminum ratio from 30 to about 200, corresponding to a silicon/aluminum atomic ratio of 100 which is, of course, well below the corresponding range called for in applicants' claims. Further, applicants' claim 24 requires the subsequent dealumination procedure to involve treating of the catalyst with a complexing agent for aluminum. As described in applicants' specification, the complexing agent forms a coordination complex with the aluminum to remove aluminum from the molecular sieve framework. In Gajda an ammonium salt is employed to remove non-framework aluminum ions. Thus, the Gajda procedure appears to involve the formation of a salt and not a coordination complex. In any event, as noted above, if Gajda were combined as suggested by the Office Action, the results would be a silicon/aluminum atomic ratio well below the minimum value specified in applicants' claims.

The rejection of claim 24 as unpatentable over EP '060 in view of Cosyns further in view of Kuehl is respectfully traversed. Again, this rejection presents a proposed combination of prior art teachings which is made possible only after a consideration of applicants' disclosure. Further, assuming the prior art references are combined, the results would still not establish obviousness of applicants' claim 24. Claim 24 requires the treatment with a complexing agent which is preceded by a heating of the catalyst in steam. The treating process in Kuehl specifically precludes the use of steam and requires that the treatment procedure be carried out at a pressure sufficient to maintain the treatment solution in the liquid phase. In this respect, Kuehl discloses in the aluminum extraction procedure described in columns 11 and 12 two different extraction procedures both of which involve the use of a chelating agent such as



ethylenediaminetetraacetic acid to remove aluminum ions which migrate out of the pores of the zeolite. This may be preceded with an extraction step employing a strong mineral acid. In both procedures, water and not steam is involved.

The rejection of claims 1, 2, 4-6, 9, 10, 13, 14, 16, and 27, as unpatentable over EP 0534142 is respectfully traversed. EP '142 is not directed to a process for cracking an olefin-rich feedstock which is selective toward propylene in the effluent. Instead, EP '142 is directed to a process for treating a naphtha feedstock to arrive at an enhanced isobutylene yield and an enhanced isopentene/total pentene ratio. As the Examiner appears to acknowledge, EP '142 specifies a upper temperature limit of 900°F (482°C) and thus fails to disclose applicants' temperature range as set forth in independent claims 1 and 27 of from 500°-600°C. The cornerstone of the rejection based upon EP '142 is that, notwithstanding the clear teaching of an upper limit below 500°C, it would be obvious to one skilled in the art to nevertheless carry out the EP '142 process at a temperature within applicants' claimed range. However, this argument ignores the fact that the express teaching of EP '142 is for a maximum temperature well below applicants' range.

It is well established law that obviousness can not be established by modifying a prior art reference in a manner directly contrary to its express teachings and accordingly for this reason alone, the rejection should be reversed. As noted by the Board of Appeals in *Ex parte Chicago Rawhide Mfg. Co.*, 223 USPQ 351, 353 (POBAI 1984):

The mere fact that a worker in the art could rearrange the parts of the reference device to meet the terms of the claims on appeal is not by itself sufficient to support a finding of obviousness. The prior art must provide a motivation or reason for the worker in the art, without the benefit of the appellant's specification, to make the necessary changes in the reference device.

Here, there is no such motivation in the prior art. The reason for the upper limit in EP '142 of 900°F is apparent from the disclosure in the reference as well as in the supporting experimental work. Bearing in mind that the purpose of EP '142 is an enhanced isobutylene yield and an enhancement in the ratio of isopentene to total pentene, the unequivocal disclosure in EP '142 is that the stated maximum of 900°F should not be exceeded. In this respect, a consideration of the experimental work presented in EP '142 shows the reason for the maximum temperature value imposed by the reference. Thus, recalling the purpose of an enhanced isobutylene yield, it is evident from the experimental work listed in Table II of the reference that the upper limit imposed by the reference should be strictly observed. Thus, considering the data in Table II, it is evidence that a maximum isobutylene yield is achieved at about 800°F with a further increase in temperature to 830°F actually resulting in a decrease in the isobutylene yield. Similarly, with respect to the iso C<sub>5</sub> olefin/total C<sub>5</sub> olefin yield, again a maximum is reached somewhere in the area of 750°F and from there goes progressively down as the temperature is increased up to 830°F. Not only is there no motivation to one of ordinary skill in the art to attempt to carry out the EP '142 process at a temperature higher than that called for in the reference, to do so would be contrary to the explicit teachings of the reference.

As further acknowledged by the Examiner, EP '142 fails to operate at a space velocity within the range of 10-30 hrs.<sup>-1</sup> and, in fact, specifies operating at much lower space velocities. Applicants would respectfully submit that the Examiner's argument that obviousness can be established by a mere assertion of similarities is clearly contrary to decisions of the Board Appeals and Patent Interferences, such as *Ex Parte Chicago Rawhide Mfg. Co., infra*. Further, when the reference is considered in its entirety, we again find that there is nothing in the prior art reference which would suggest increasing the space velocity dramatically from that disclosed in

the reference, and in fact, the reference actually teaches to the contrary. Again, based upon the limited experimental work set forth in EP '142, we find that an increase in space velocity under otherwise similar experimental conditions (the first and second columns of Table II) results in a decrease in both the isobutene yield and the iso-C<sub>5</sub> olefins/total C<sub>5</sub> olefins ratio. It would not be obvious to one of ordinary skill in the art viewing this experimental work to carry out the reference process modified in a manner to employ a three-fold or more increase in space velocity beyond that actually specified in the reference. Again, the proposed modification of the prior art reference is directly contrary to its express teachings. There is no motivation to the worker in the art to operate within applicants' ranges of temperature and space velocity, and in fact, the motivation is against making these changes.

Further, with respect to EP '142, the various tables presented in this reference have been carefully considered and do not appear to support the assertions made in the Office Action regarding propylene yield, relative amounts of olefins in the feed and the product, and the olefinic content of the C<sub>2</sub> to C<sub>3</sub> fraction of the product stream. In fact, while feed analysis is presented in some examples in detail with respect to some components and product analysis in other examples with respect to some components, principally isobutylene and various pentenes, there does not appear to be an overall analysis in which factors such as propylene yield based upon olefin content in the feed, relative olefin contents, and C<sub>2</sub> , C<sub>3</sub> olefin contents can be calculated.

The rejections presented in pages 13-15 of the Office Action based upon the combination of EP '142 in combination with Cosyns and Gajha or in combination with Cosyns in view of Kuehl closely parallel the corresponding rejections based upon these secondary references in combination with EP '060. In this respect the reference to EP 010960, on pages 14 and 15, is

understood to be a misprint with the intended reference being EP 534142. Applicants' comments made above with respect to the proposed combination of the secondary references with EP '060 are considered to be fully applicable to these same secondary references as applied in combination with EP '142, and accordingly, the arguments previously presented will not be repeated here.

As demonstrated by the foregoing remarks, it is respectfully submitted that the combinations of the various secondary references with the primary references cannot be made in a manner to arrive at applicants' invention even if it were appropriate to use applicants' teachings as a basis for combining the diverse teachings of the references. This, however, is not the appropriate standard to be applied in combining prior art teachings. The appropriate standard forbids using an applicant's own disclosure as a basis for assembling prior art teachings and requires a suggestion or motivation in the prior art as reflected in decisions in *ACS Hospital Systems, Inc. v. Montefiore Hospital*, 221 USPQ 929 (Fed. Cir. 1984) and *Ex parte Giles* 228 USPQ 886 (PTO Bd. Of Appeal. And Int. 1985). As expressed by the Board in *Giles* at 688:

Only appellant's disclosure and not the prior art provides a motive for achieving the combination as claimed by the appellant. To imbue one of ordinary skill in the art with knowledge of the invention . . . when no prior art reference or references of record convey or suggests that knowledge is to fall victim to the insidious effect of a hindsight syndrome wherein that which only the inventor taught is used against its teacher.

Attention is also respectfully invited to the Federal Circuit decision in *In re Fine*, 5 USPQ2d 1956 (Fed. Cir. 1988) wherein the Court stated at 1600:

It is essential that "the decisionmaker forget what he or she has been taught at trial about the claimed invention and cast the mind back to the time the invention was made . . . to occupy the mind of one skilled in the art who is presented only with the references, and who is normally guided by the then-accepted wisdom in the art." *Id.* One cannot use hindsight reconstruction to pick and choose among isolated disclosures in the prior art to deprecate the claimed invention. (Emphasis added)

The admonitions in *Ex parte Giles* and *In re Fine* are to step back in time to evaluate the invention only in the context of what is disclosed in the references without regard to what is disclosed in appellants' specification. When this is done, it is believed clear that one of ordinary skill in the art would not arrive at appellants' invention based only upon the references and "the then-accepted wisdom in the art."

For the reasons advanced above, it is respectfully submitted that this application is in condition for allowance, subject only to the possibility of a double-patenting rejection should an issue presented by the provisional double-patenting rejections come into being. As indicated in applicants' previous response, a terminal disclaimer will be filed when appropriate.

Enclosed are two checks, one in the amount of \$110.00 to cover the fee for a one-month extension for the filing of this Amendment and the other in the amount of \$170.00 to cover the fee for one additional independent claim and five additional dependent claims.. The three-month period for filing a response to the October 10, 2000, Office Action was set to expire January 10, 2001, but with the payment of this extension fee, the response time is extended to February 10, 2001. Since February 10, 2001, is a Saturday, this response is being deposited with the U.S. Postal Service on Monday, February 12, 2001.

The Commissioner is hereby authorized to charge out Deposit Account No. 12-1781 for any further fees connected with this communication.

Respectfully submitted,

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